CHAPTER I.   INTRODUCTION

Infant mortality is a major public health concern, both nationally and in King County, Washington. The slow rate of decline in infant mortality in King County between 1984 and 1988, and the persistent disparity between rates among whites and African Americans, led the Seattle-King County Department of Public Health to establish an infant mortality review in 1992. The main goals of the review were to establish a system to monitor infant deaths and identify factors that contribute to infant deaths and can be changed.

This is the first report of the findings of the review. It is divided into two major parts. Part One provides an overview of trends in infant mortality from 1980-1994 using statistical data from birth and death certificates. Part Two contains provides more detailed information from a case-by-case review of 247 infant deaths occurring between 1992-1994.

THE SIGNIFICANCE OF INFANT MORTALITY

Infant death remains one of the largest components of mortality from birth into adulthood. Few life experiences are as tragic as the death of a loved child. The sense of loss that families experience is one of the main reasons why infant mortality continues to command such intense public attention and general public sympathy.

A community's infant mortality rate is a fundamental indicator of its health and well-being. As such, it is not only an important health measure but also an intensely political indicator. The infant mortality rate in the United States ranks among the highest of any industrialized nation. A child born in Japan, Finland, Hong Kong, Ireland, Australia, Canada, Singapore or one of twelve other industrialized nations has a better chance of surviving his or her first year than a child born in the United States.[1] Furthermore, the United States ranked 24th among the nations of the world in 1988, with an infant mortality rate of 10 per thousand live births. The African-American rate for the same year was 17.6 compared to a rate of 8.5 for whites. The National Commission to Prevent Infant mortality has estimated that at least half of these 40,000 deaths per year were preventable.

WHY AN INFANT MORTALITY REVIEW?

In 1988, the United States Public Health Service proposed that communities develop local reviews of infant deaths as a specific strategy to reduce infant mortality rates. This approach featured a community-specific examination of a broad array of social, economic, public health, behavioral, administrative, educational, environmental and health and social service systems factors related to maternal and child health. Policy makers recognized that economic, social, and environmental forces as well as limited access to health care were important factors that had an impact on infant health, a hypothesis supported by the scientific literature. Socioeconomic characteristics, such as low income [2,3,4,5,6] and fewer years of parental education [7,8] had been shown to be associated with higher infant mortality rates. Similarly, smoking and substance abuse had been strongly associated with elevated rates.[9,10,11,12,13,14] Inadequate use of and lack of access to health care,[15,16,17,18,19,20,21] stress,[22,23] and lack of social support [24] had been shown to increase low birthweight and prematurity, both of which are major causes of infant mortality. A lack of understanding of risk factors and interventions for Sudden Infant Death Syndrome (SIDS) and prematurity, the most common causes of infant death, frustrated efforts to decrease infant mortality.

At the same time, concern regarding infant deaths was growing in King County, Washington. Improvements in the infant mortality rate slowed or ceased during the mid 1980s.[25] The large disparity between the number of deaths of African American and white infants also increased during this time period.

While the traditional approach of analyzing data from vital records provided a great deal of information about infant mortality, it also left unanswered many questions that could only be addressed through the systematic evaluation of individual cases at the local level. Autopsy reports have added some additional information, but classification of infant deaths with such restricted information has offered limited insight into the prevention of infant deaths. Therefore, the review established an on-going system for conducting detailed case review of infant deaths. By collecting information from interviews with the caretakers of infants who died and by reviewing medical and social service records, a fuller picture emerged. In addition to examining the more traditional biological risks for infant death, this additional information facilitated identification of factors associated with the delivery of health and human services, inadequate social support for pregnant women and families, stress, substance abuse and poverty.

The Seattle-King County Department of Public Health's infant mortality review was comprised of two parts: the case review and the case-control study. The case review included systematic evaluation of individual infant deaths by an interdisciplinary team which confirmed the infant's cause of death and identified factors that had contributed to his or her death. The team then developed recommendations for addressing the modifiable contributing factors with the intention of reducing the occurrence of these factors in order to prevent future deaths.

Case review alone can suggest that a particular factor may have been related to infant death. However, the likelihood that a factor did indeed contribute to the deaths is greater if it can be shown that the factor occurred more often among infants who died than among those who survived. The project therefore collected information on a group of infants who survived infancy (control group) and compared them to those who died (case group), using the epidemiological tool of case-control analysis. The results of this analysis will be presented in a future report.

HOW TO READ THIS REPORT

This report uses a number of epidemiological methods and technical terms to analyze data on infant mortality. The following definitions and explanations will assist the reader in studying this report.

Epidemiology: The study of the distribution and determinants of health conditions in a specified population and the application of this study to the control of health problems.[26]

Infant Mortality Rate: The infant mortality rate is the number of live born infants who die before reaching their first birthday in a given year, for every 1,000 infants born alive in that year.

Low Birthweight: A newborn weighing less than 2,500 grams (5.5 pounds) is considered to be low birthweight.

Preterm/Premature Birth: The average pregnancy lasts 40 weeks. An infant born at less than 37 weeks gestation is considered premature or preterm. The gestational age of a newborn is calculated as the interval between the newborn's date of birth and the first day of the mother's last menstrual period before she conceived.

Rate Per 1,000: Using the infant mortality rate as an example, this is the total number of infant deaths occurring within a population (such as King County), during a specified time period (usually a year), divided by the total population (all live births in King County) during the same time period, and then multiplied by 1,000. The resulting rate is the number of events occurring in a group of 1,000 members of the population being described.

Rolling Averages: For populations of small size, small changes in the number of events can cause large fluctuations in rates, making year-to-year changes difficult to interpret. To help stabilize the rate for the examination of a time trend of an event, the rates are aggregated into "rolled" averages (such as in 3 or 5 year intervals) across the total observed period. For example, if there is a highly fluctuating rate caused by low numbers of events for years 1987 through 1992, the rates are instead reported as three-year rolling averages: 1987 to 1989, 1988 to 1990, 1989 to 1991, 1990 to 1992. Each set of three year averages includes a higher number of cases than a single year, and thus smoothes out random year-to-year fluctuations. A disadvantage of rolling averages is that they can make it hard to see the beginning of recent trends. We always look at year-by-year trends before computing rolling averages to ensure they accurately reflect the data.

Significant Trend: Epidemiologists use a statistical test called the chi-square test to see whether a change in a rate is statistically significant. A significant trend indicates that the change in a rate is not random and that an increase or decrease is likely to be occurring in a population. Trend tests are always applied to year-by-year trends, not rolling averages. The significance level used for a significant trend is $p < 0.05$.

Relative Risk/Odds Ratio: The relative risk is the ratio between rates for two different groups. For example, if the infant mortality rate for African Americans is 20 per 1,000 live births and that for whites is 10 per 1,000, then the rate ratio is $20/10 = 2.0$. This means that African American infants are 2.0 times as likely to die as compared to white infants. The odds ratio, derived from case-control studies, provides information similar to the relative risk.

Risk Difference: This is the difference of risk between rates for two different groups. For example, if the infant mortality rate for African Americans is 20 per 1,000 and 10 per 1,000 for whites, then the risk difference is $20 - 10 = 10$ per 1,000. This means that ten more deaths occur among every 1,000 African American infants than among every 1,000 white infants.

Excess Number of Deaths: The excess number of deaths in group A relative to group B is the excess number of actual (observed) deaths in group A over the number of deaths expected to occur in group A if group A had the same rate of deaths as group B. For example, to calculate excess deaths for African American infants as compared to whites for the year 1993, first the **Expected Number of Deaths** for African Americans is calculated as follows:

$$\text{expected deaths }_{\text{African American}} = (\text{infant mortality rate }_{\text{white}}) \text{ x } (\text{number of births }_{\text{African American}})$$

The **Excess** African American Death is then calculated as follows:

$$\text{excess deaths }_{\text{African American}} = (\text{observed deaths }_{\text{African American}}) - (\text{expected deaths }_{\text{African American}})$$

For example, if the infant mortality rate for whites in 1993 was 5/1000 and the total African American number of births for 1993 was 1559, then the expected number of deaths would be :

$$\text{expected deaths } (5/1000) \text{ x } 1559 = 8.$$

If the actual number of African American deaths was 18, then the excess African American deaths would be:

$$\text{excess deaths} = 18 - 8 = 10.$$

This means that African Americans had 10 excess infant deaths as compared to whites.

Bar Charts With Confidence Intervals: The following is important to note when reading a bar chart: the top of each bar represents the actual value of the rate. The black line marked with two endpoints at the top of each bar represents the 95 percent confidence interval of the rate. Again, we expect the true rate to fall within the confidence interval 95 percent of the time. If you are comparing two rates with each other and the confidence intervals overlap, the rates are not considered to differ statistically from each other.

Regions: We have also divided King County into four major regions because of important differences in birth rates across these regions: North and South Seattle and East/North and South County. The approximate boundary between the two Seattle regions is Mercer Street and between the County regions is SE May Valley Road. The region definitions are contained in Appendix A.

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